MEMORANDUM

Memorandum Regarding Use of Corrective Action Management Unit for Impoundments 1 and 2, American Cyanamid Superfund Site, Bridgewater, New Jersey

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DATE:	December 9, 2016

CH2M HILL (CH2M) has developed this memorandum on behalf of Wyeth Holdings LLC (WH) in response to a request by the United States Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection (NJDEP) to evaluate the development of a potential treatment objective for the performance criteria that might be applicable to alternatives involving placement of treated material from Impoundments 1 and 2, Operable Unit 8 (OU8), into the Impoundment 8 Facility corrective action management unit (CAMU) at the American Cyanamid Superfund Site in Bridgewater, New Jersey (Site).

Specifically, this memorandum presents a summary of how treatment objectives were previously established for material treated and relocated from Impoundments 14 and 20 to the Impoundment 8 Facility CAMU. It also describes how a similar process could be used to develop potential treatment objectives under Alternative 5, which is being considered in the OU8 Focused Feasibility Study (FFS) and which contemplates the disposal of the treated contents of Impoundments 1 and 2 in the CAMU.

Introduction

To develop an effective remedial approach for addressing Impoundments 1 and 2, bench-scale treatability studies and a field-scale pilot study were completed between 2012 and 2016 to evaluate technologies that might be effective for remediation of Impoundments 1 and 2 (CH2M 2014, 2015a).

To support development and analysis of remedial alternatives as part of the FFS, performance criteria for evaluating the ability of each remedial alternative to achieve the Remedial Action Objectives (RAOs) established for OU8 were developed and presented in the September 2015 *Technical Memorandum – Proposed Performance Criteria for Remedial Alternatives* (CH2M 2015b) (the "Performance Criteria Memorandum"). In addition, a *Technical Memorandum – Technology Screening Memorandum to Support Alternatives Development* (CH2M 2015c) (together with the Performance Criteria memorandum, the Technical Memoranda) was developed describing the technology screening process and presenting the technologies and process options retained for subsequent development of remedial alternatives as part of the FFS. EPA approved the Technical Memoranda, including the performance criteria for alternatives that involve use of the Impoundment 8 Facility CAMU, via a letter dated October 15, 2015 (EPA 2015a).

The bench-scale and pilot study results along with the Technical Memoranda were used to develop a preliminary list of remedial alternatives, which was presented to EPA on November 4, 2015. While the

information obtained during the bench-scale and pilot studies completed in 2012 and 2014 was sufficient to develop certain alternatives, it was determined that additional laboratory-scale testing was required to evaluate the feasibility and effectiveness of two additional technologies for treating acid tar in Impoundments 1 and 2: thermally enhanced in situ solidification and stabilization (ISS) and mechanical dewatering followed by offsite treatment at a cement kiln or incinerator. Additional laboratory studies were conducted in 2016 to evaluate these technologies and the compatibility of the CAMU liner with leachate generated from treated impoundment material. The results of these studies were used to develop a refined list of remedial alternatives, which was presented to EPA and NJDEP on October 13, 2016. The preliminary alternatives are grouped based on end point into the following three categories: 1) treatment and closure in place with robust engineering controls, 2) treatment followed by removal and placement in the onsite CAMU, and 3) excavation, dewatering, and offsite shipment for beneficial reuse at a cement kiln (CH2M 2016a, CH2M 2016b, O'Brien & Gere [OBG] 2016).

There was general agreement on the refined list of remedial alternatives; however, NJDEP suggested that a quantitative treatment objective may be needed for remedies that involve placing treated material in the onsite CAMU. As noted in the list of alternatives presented to EPA and NJDEP in October 2016, Alternative 5 involves using steam while homogenizing impoundment materials to enhance removal of constituents of concern (COCs). This is followed by ISS to increase strength and neutralize the acidity, then excavation and placement of treated material in the onsite CAMU. This is then followed by the final step of backfilling the excavation with berm materials, and installation of a vegetated soil cover over the excavated impoundment area.

In response to NJDEP's suggestion regarding a quantitative treatment objective, EPA recommended a review of how treatment objectives were established as part of the 1997 Corrective Measures Study (CMS), which is summarized in the 2007 Remedial Action Plan and the 2007 Explanation of Significant Difference (ESD) for Impoundments 14 and 20. Treated materials from these two impoundments were placed in the CAMU (OBG 2007, Environ 1997, NJDEP 2007). The subsequent sections of this memorandum summarize the process used to develop the treatment objectives for Impoundments 14 and 20 and present a proposed approach for evaluating potential treatment objectives for Impoundments 1 and 2.

Overview of Risk Evaluation Process and Establishment of Treatment Objectives for Impoundments 14 and 20

The 2007 Remedial Action Plan for Impoundments 14 and 20 includes, as Exhibit 1, the 1997 Risk Ranking Evaluation, which details the approach used to calculate a relative risk factor (RRF) for organic compounds detected in the Group III impoundments, which included Impoundments 1, 2, 3, 4, 5, 14, 20, and 26 (OBG 2007, Environ 1997). In summary, RRFs were developed to evaluate potential risk posed by ingestion exposure to COCs leaching to groundwater and represented the relative risk posed by individual constituents. While the overall RRF was determined by summing the individual RRF contributions of individual COCs, benzene was the primary risk driver based on its relative mass and associated risks. The equation used to calculate the RRF for benzene was:

$$RRF_c = RMF \times SF_{oral}/(K_d \times 10^{-6})$$

Where:

RRF_c = RRF for carcinogens
RMF = Relative Mass Factor
SF_{oral} = Oral slope factor value
K_d = soil-to-water partitioning coefficient

The percent risk reduction associated with a specific remedial action alternative was then calculated as follows:

$$\text{Percent Risk Reduction} = (RRF_{baseline} - RRF_{treated})/RRF_{baseline} \times 100$$

The RRF under baseline conditions (untreated) was calculated using the maximum concentrations detected in each impoundment.

Constituent-specific treatment objectives were initially developed (Environ 1997) based on consideration of two scenarios:

1. The COC concentration corresponding to a 90 percent reduction in RRF: Based on the data presented in the Risk Ranking Evaluation, reducing the benzene concentration to 2,000 milligrams per kilogram (mg/kg) across the seven Group III impoundments would reduce the overall risk by approximately 90 percent.
2. The COC concentration that the selected technology could theoretically achieve based on bench studies: For benzene, this was an average of 54 mg/kg and a maximum value of 60 mg/kg.

The treatment objectives for several COCs were later modified based on what the technology actually achieved in practice. In the 2007 ESD, the treatment objective for benzene in Impoundments 14 and 20 was modified to 2,529 mg/kg because full-scale demonstration of the implemented technology demonstrated that this was the achievable concentration. As noted in the ESD, this represented a reduction in benzene concentration of approximately 28 percent (see Attachment A). Between September 2007 and September 2009, approximately 33,101 cubic yards of treated material from Impoundments 14 and 20 were placed in the Impoundment 8 Facility CAMU.

Approach for Calculating Risk Reduction for Impoundments 1 and 2

For Impoundments 1 and 2, a technology-based benzene concentration has been identified (in this case, for steam-enhanced ISS). Bench-scale treatability tests evaluating the use of steam-enhanced ISS reported a post-treatment benzene concentration of 16,000 mg/kg following 2-hours of mixing; however, because this result is based on laboratory-scale testing, a 50 percent increase in the treated concentration is conservatively assumed. Therefore, the estimated benzene concentration of material to be placed in the CAMU under Alternative 5 is 24,000 mg/kg. This is similar to the concentration achieved for ISS treatment during the pilot study.

To quantify the associated risk reduction using the methodology utilized for Impoundments 14 and 20, the aforementioned RRF calculations were performed. The baseline condition RRF was calculated using the 95 percent upper confidence limit (UCL) benzene concentrations for Impoundments 1 (88,212 mg/kg) and 2 (65,288 mg/kg) (OBG, 2010) and recent estimates of impoundment volume. As shown in Table 1, the RRF for baseline conditions is 9.43×10^{14}. The RRF for treated material was calculated using a concentration of 24,000 mg/kg and a 15 percent increase in volume (assumes 15 percent ISS reagent addition); the treated RRF is 3.45×10^{14}. A comparison of the baseline and treated RRF values shows that this technology results in a 63.4 percent reduction in risk.

Conclusions

Based on bench-scale treatability testing results and considering a scale up factor, the concentration of benzene in the steam-enhanced-ISS-treated material from Impoundments 1 and 2 is conservatively estimated to be 24,000 mg/kg. Applying the risk-reduction evaluation methodology used in the Group III Impoundments CMS and Impoundments 14 and 20 ESD, implementation of steam-enhanced ISS at Impoundments 1 and 2 would be expected to reduce relative risk more than 63 percent.

In addition, excavation of the treated material from the floodplain and placement in the CAMU (a managed, secure landfill with a cap and liner system) results in additional reduction of risk. The Impoundment 8 Facility CAMU has a multi-layer leachate collection system and will include an impermeable cover upon closure. Relative to untreated material (i.e., the current status and condition of the impoundments), treatment and placement of the material in the CAMU results in more than a 99.9 percent reduction in risk when engineering controls are considered, due to the decrease in mass from steam-enhanced ISS treatment and reduced leachability by management in the engineered CAMU.

This analysis demonstrates that Alternative 5, as described above, is protective of human health and the environment. If a treatment objective more stringent than 24,000 mg/kg is imposed, then a new alternative would need to be developed, evaluated and screened against the balancing criteria to determine whether the alternative should be included in the FFS report.

References

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Table 1. Risk Reduction Factor Calculations, Impoundments 1 & 2, Steam-Enhanced ISS, Excavation and Placement in CAMU

Scenario 1: Baseline Conditions

Impoundment Volume

Volume (cubic yards)

Imp. 1	Imp. 2	Total
2.42E+04	3.03E+04	5.45E+04

Concentration Information

95% UCL (OBG 2010)

Imp. 1	Imp. 2
8.82E+04	6.53E+04

Contaminant Specific Information

Compound	SForal	RfDoral	Kd	
Benzene	5.50E-02	-	2.40E-01	Only carcinogenic effects, no RfDoral available

Relative Mass Factor

$$RMF = \sum_{i,j} (C_{ij})\ (V_j)\ (D_j)$$

Where:
C = concentration of chemical I in Impoundment j (mg/kg)
V = volume of waste in Impoundment j (cubic yards)
D = relative density ratio of waste in Impoundment j (unitless)

RMF

Imp. 1	Imp. 2	Total
2.13E+09	1.98E+09	4.11E+09

Relative Risk Factor

$$RRF_c = RMF \times SF_{oral} / (K_d \times 10^{-6})$$

$$RRF_{nc} = RMF / (RfD_{oral} \times K_d \times 1)$$

RRFc	9.43E+14

Relative density ratio of waste impoundment (unitless)	**D**	1

Table 1. Risk Reduction Factor Calculations, Impoundments 1 & 2, Steam-Enhanced ISS, Excavation and Placement in CAMU

Scenario 2: Treated Conditions

Impoundment Volume

Volume (cubic yards)

Imp. 1	Imp. 2	Total
2.78E+04	3.48E+04	6.27E+04

ISS Addition Rate **15%**

Concentration Information - Treatment Objective

Average Concentration (mg/kg)

Imp. 1	Imp. 2
2.40E+04	2.40E+04

Relative Mass Factor

RMF

Imp. 1	Imp. 2	Total
6.68E+08	8.36E+08	1.50E+09

Relative Risk Factor (treated conditions)

RRFc	3.45E+14

Percent Risk Reduction Achieved

PRR (%)	63.4

ATTACHMENT A

Explanation of Significant Difference Impoundments 14 and 20, American Cyanamid Site

EXPLANATION OF SIGNIFICANT DIFFERENCE
IMPOUNDMENTS 14 AND 20

AMERICAN CYANAMID SITE
BRIDGEWATER TOWNSHIP, SOMERSET COUNTY
NEW JERSEY

New Jersey Department of Environmental Protection
Site Remediation Program
Bureau of Case Management
31May2007

EXPLANATION OF SIGNIFICANT DIFFERENCES
IMPOUNDMENTS 14 & 20
AMERICAN CYANAMID SUPERFUND SITE

Site Name and Location

American Cyanamid Superfund Site
Bridgewater Township, Somerset County, New Jersey

Introduction

The purpose of this Explanation of Significant Differences (ESD) is to explain the changes made by the New Jersey Department of Environmental Protection (NJDEP) and the United States Environmental Protection Agency (EPA) to the October 1998 Record of Decision (ROD) Operable Unit 3 (OU3), at the American Cyanamid Superfund Site (the site). The ROD called for, as one component of a multipart remedy, aerobic biotreatment of Impoundment 4, 5, 14, and 20 materials, solidification thereafter as necessary for strength, and placement in Impoundment 8 (a permitted, state-of-the-art hazardous waste management facility). This ESD specifically addresses the remedy for the material from Impoundments 14 and 20 only.

In 2002, material from Impoundments 14 and 20 was excavated and placed in managed stockpiles before the start of the aerobic biotreatment program, consistent with the OU3 ROD. During pilot testing to establish permit conditions with the NJDEP and to satisfy the requirements specified in the ROD, it was concluded that aerobic biotreatment on the Impoundment 14 and 20 materials was not attainable as originally determined in the 1998 Feasibility Study. Due to difficulties in consistently remaining within air emission permit values, the inability to meet the overall treatment objectives determined in the ROD, much longer projected treatment rates and burdensome costs, the biotreatment program was reassessed.

While the ROD remedy was being reassessed, the Impoundments 14 and 20 material stockpiles were covered with a waterproof semi-airtight fabric for approximately three and a half years. These storage conditions, designed for storage until a new remedy could be identified, supported anaerobic microbial activity within the storage stockpiles. Subsequent laboratory sample analysis of the material, conducted as part of the reassessment, discovered that substantial reduction in the compounds of concern had occurred under anaerobic conditions. Comparison of these sample results with the Treatment Objectives required by the 1998 ROD indicated that anaerobic biodegradation successfully treated the semi-volatile organic compounds (SVOC) and considerably reduced volatile organic compound (VOC) concentrations. NJDEP and EPA have concluded that anaerobic biodegradation is not expected to achieve the 1998 Treatment Objectives for VOC, even with additional staging/treatment time. Moreover, the cover fabric for the Impoundments 14 and 20 staging piles is reaching the end of its useful life. Given these factors, NJDEP and EPA have determined that continuing to stage the Impoundment 14 and 20 material until other remedies might be considered would not be appropriate. This ESD is necessary to change the Treatment Objectives for the Impoundment 14 and 20 material and allow it to be placed in the Impoundment 8 facility without further biotreatment. This material will be solidified and placed within the Impoundment 8 facility as intended in the 1998 ROD.

The NJDEP is the lead government agency, overseeing cleanup at this site. The EPA acts as the support agency. EPA concurs with the ESD. The NJDEP issues this ESD in accordance with Section 117(c) of

the Comprehensive Environmental Response, Compensation & Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. §9617(c), and Section 300.435 (c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. §300.435(c)(2)(i).

Summary of Site History, Contamination Problems and Selected Remedy

Throughout its more than 75-year manufacturing history, numerous organic and inorganic chemical raw materials were used at the facility to produce products including rubber chemicals, pharmaceuticals, dyes, pigments, chemical intermediates, and petroleum-based products. In June of 1999, all manufacturing ceased at the site. By November 2000, all production buildings on site had been demolished.

Past manufacturing and disposal activities at the site resulted in a number of areas, or "Impoundments", used for waste storage and disposal as well as areas of soil and ground water contamination (See Figure 1). Out of 27 Impoundments originally identified at the site, 16 were determined to be potentially contributing to ground water contamination and, therefore, deemed necessary to be addressed under CERCLA. These 16 Impoundments have since been identified using numbers 1, 2, 3, 4, 5, 11, 13, 14, 15, 16, 17, 18, 19, 20, 24, and 26. The other 11 Impoundments were either never used, contain only river silt from the facility's former river water treatment plant, contain emergency fire water, or have been closed (or are being closed) in accordance with approved Resource Conservation and Recovery Act (RCRA) closure plans. Impoundments 6, 7, 8, and 9A are being closed under RCRA because they were classified under RCRA as Treatment/Storage/Disposal (TSD) facilities. The 16 CERCLA classified Impoundments were used for storing by-products of rubber chemical production, dye production, and coal tar distillation, as well as for disposal of general plant waste and demolition debris. These Impoundments were originally estimated to contain 877,000 tons of waste material.

The site was added to the National Priorities List (NPL) in 1983.

In an effort to ease the remediation process, the Impoundments were placed into three separate groups according to waste type, nature of contaminants, and geographical location. The Impoundment groups are as follows:

Group I - Impoundments 11, 13, 19, and 24
Group II - Impoundments 15, 16, 17, and 18
Group III - Impoundments 1, 2, 3, 4, 5, 14, 20, and 26

All site cleanup activities are being addressed under a May 1988 (Amended May 1994) Administrative Consent Order (ACO) between American Cyanamid and NJDEP. Wyeth, formerly American Home Products Corporation, purchased American Cyanamid Company in 1994 and assumed full responsibility for environmental remediation at the site.

Due to the size and nature of the contamination at this site, seven Operable Units (OU) address the site Impoundments or groups, remaining soil, groundwater, wetlands and a separate portion of the site known as the Hill Property. The OU are identified as the following:

- OU1: Impoundments 11, 13, 19, and 24 (Group I)
- OU2: Impoundments 15, 16, 17, and 18 (Group II)
- OU3: Impoundments 1, 2, 3, 4, 5, 14, 20 and 26 (Group III)
- OU4: Site Soils

- OU5: Site Groundwater
- OU6: Hill Property
- OU7: Site-related Wetlands

Since the early 1990s, the PRP, NJDEP and EPA have pursued a remedial strategy of addressing the various Impoundment Groups first before undertaking remedies that address the site as a whole. To date, RODs have been signed for OU1 (9/28/93), OU2 (7/12/96), OU3 (9/28/98) and OU6 (7/12/96). Remedies for OU4 - site-wide soils, OU5 - ground water and, OU7 - site-related Wetlands have yet to be selected.

In 2004, as implementation of the Impoundment remediations progressed, it became apparent that the site's remedial strategy was not the most expeditious manner in which to address the remaining contamination at the site. In response, Wyeth submitted several reports to NJDEP and EPA recommending a temporary suspension of remedial design and remedial action work for the remedy selected for OU3 and proposing a reassessment of the entire site through an action characterized as a Comprehensive Site-Wide Feasibility Study. In its proposal, Wyeth stated that the remedy selected for Impoundments 14 and 20 could not be performed as intended, based on technical infeasibility. Difficulties included managing air emissions within permittable levels, a schedule to complete estimated at between 15 and 20 years, and a major cost escalation over the original estimate provided in the OU3 ROD. Based on these difficulties and the belief that previous decisions may also benefit from an overall comprehensive review, Wyeth proposed the development of a plan to reassess the OU3 remedial action and the other ROD remedies, as well as to complete the remaining remedial investigations/studies for site-wide soils, ground water, and wetlands, along with evaluating potential future-use plans for the site. All phases are to be combined into a single comprehensive program. NJDEP and EPA allowed Wyeth to proceed with this approach.

Progress of Programs

OU1 ROD signed on September 28, 1993

This ROD addresses OU1 surface Impoundments 11, 13, 19 and 24 (Group I). The nature of the contamination in these Impoundments consists of sludges, silts and soils containing inorganic compounds, organic compounds and metals. The major components of the selected remedy include: excavation of the waste material from Impoundments 11, 13, 19 & 24; on-site solidification of excavated material; and consolidation of the solidified material into the Impoundment 8 Facility.

The remediation of Impoundments 11 and 19 is complete. Impoundments 13 and 24 were found to contain less contaminated materials than anticipated in the ROD. Wyeth, with NJDEP concurrence, elected to address these two remaining Impoundments at a later date.

OU2 ROD signed on July 12, 1996

This ROD addresses OU2 surface Impoundments 15, 16, 17 and 18 (Group II). The nature of the contamination in these Impoundments consists of materials containing organic compounds and metals. The major components of the selected remedy include: excavation, consolidation, capping and security measures. For Impoundments 15 and 16: excavation of the material in Impoundment 16 and consolidation into Impoundment 15; construction of a cap (synthetic liner); and, ground water monitoring.

This remedy was modified by NJDEP with an ESD on November 30, 1998. The ESD selected an alternative remedy consisting of recycling of the material (iron oxide) within both Impoundments 15 and

16. The recycling started in the spring of 2000 and is expected to continue for up to 20 years.

Impoundment 17: Excavation of the material, solidification; and, placement of the material into Impoundment 8.

Impoundment 18: Construction of a fence, perform berm improvements where necessary; maintenance of natural vegetation; and, ground water monitoring.

The remediation of Impoundment 17 has not been initiated. The closure of Impoundment 18, which consisted of installing a security fencing, conducting berm improvements and maintenance of natural vegetative cover, has been completed. As of June 2004, all remaining remedial activities associated with this OU have been suspended pending the results of a "Comprehensive Site-wide Feasibility Study" being performed by Wyeth.

OU6 ROD signed on July 12, 1996

This ROD addresses OU6, known as the Hill Property. The Hill Property consisted of some administrative and research buildings. The use of these buildings was limited. The major components of the selected remedy include: recovery of the residual ground water contamination and transfer to the site's main recovery facility; ground water monitoring; and maintain Water Use Restrictions established under a NJDEP Classification Exception Area (CEA) until all of the residual ground water contamination has been recovered.

Based on the site investigations, no remedial actions were required for the Hill Property soils.
The Hill Property portion of the site was deleted from the NPL on December 29, 1998.

OU3 ROD signed on September 28, 1998

This ROD addresses OU3 surface Impoundments 1, 2, 3, 4, 5, 14, 20, and 26. These Impoundments are considered the most contaminated and complex at the site. Each Impoundment's material and selected treatment were classified into five different categories, along with the associated remedy, as described below.

Category A material: High British Thermal Unit (BTU) tar within Impoundments 1 and 2 - Low-Temperature Thermal Treatment (LTTT) and placement of treated material in Impoundment 8; **Category B:** Low BTU tar within Impoundments 4, 5 (wet), 14, and 20 - Biotreatment and placement of treated material in Impoundment 8; **Category C: Impoundment** 3 material (tar mixed with soil fill) - LTTT and placement of treated material in Impoundment 8; **Category D**: Non-hazardous material of Impoundments 5 (dry) and 26 - Consolidation in Impoundment 8; and **Category E**: General plant debris of Impoundments 3, 4, 5, 14 and 20 - Consolidation in Impoundment 8.

All residual waste is to be treated to the levels specified in the ROD prior to consolidation into Impoundment 8. The OU3 ROD requires that material of Categories D and E are to be conditioned to meet the RCRA placement requirements (strength and physical compatibility) prior to consolidation into Impoundment 8.

The remediation of the OU3 Impoundments has been initiated. The current status of these Impoundments, grouped by material type, is as follows:

+ **Category A material:** A Pilot Test was conducted on-site during the Fall-Winter of 2000.
+ **Category B**: In the spring of 2002, in preparation for the biotreatment of material, Impoundments 14 and 20 were excavated, combined and placed in managed stockpiles. Pilot tests indicated that the ROD remedy, aerobic biotreatment, would not be implementable for this material. The failure of this technology precipitated the Comprehensive Site-Wide Feasibility Study and has resulted in this ESD.
+ **Category C**: No activity has been started to address this material.
+ **Category D**: Approximately 26,600 cubic yards of material was excavated from Impoundment 26, solidified with cement and placed in the Impoundment 8 Facility. In 2002, approximately 16,381cubic yards of material was removed from Impoundment 5 (dry), solidified and placed in the Impoundment 8.
+ **Category E**: Debris excavated from Impoundment 5 (dry) was mixed to the extent possible with the 5 (dry) material and subsequently placed in Impoundment 8. A 946-cubic yard debris pile excavated from Impoundment 5 (dry) consisting of oversize debris could not be readily reduced and currently is staged on site.

As of June 2004, all remaining remedial activities associated with this OU have been suspended pending the results of the Comprehensive Site-wide Feasibility Study.

OU4 - Surface Soils

This Program is being evaluated as part of the Comprehensive Site-Wide Feasibility Study.

OU5 - Ground Water

To control ground water contamination related to the site, Wyeth operates bedrock production wells with pumping at a minimum weekly average of 650,000 gallons per day. A final remedy for ground water is being evaluated as part of the Comprehensive Site-Wide Feasibility Study.

OU7 - Site-related Wetlands (Natural Resource Assessment)

This OU is being addressed through a natural resource assessment. For this assessment, Wyeth collected sediment and surface water samples in May and June 2000, and a Data Summary Report was issued to NJDEP and EPA in November 2000. A Human Health Risk Assessment Report (HHRA) and Baseline Ecological Risk Report (BERA) were submitted to NJDEP and EPA in August 2003 and February 2004, respectively. NJDEP and USEPA approved the BERA and HHRA on July 1, 2005 and March 28, 2007, respectively.

Description of the Significant Differences and the Basis for those Differences

In November of 1997, a Corrective Measures Study/Feasibility Study (CMS/FS) report was approved for the Group III Impoundments. In this 1997 document, material from the Group III Impoundments was divided into five categories, A through E. Material Category B, identified as low BTU tar and sludge, included Impoundments 4, 5 (wet), 14, and 20. A limited-scale field program was performed to test aerobic biotreatment for its ability to treat the material within a reasonable time frame and to acceptable concentrations. The results of the limited-scale field program identified excavation, aerobic biotreatment, stabilization, and placement in the on-site RCRA-permitted facility (Impoundment 8) as the appropriate remedy for the Category B material. The results were also used to establish technology-based compound-specific Treatment Objectives for eight compounds identified as the most significant contributors to the risk

presented by the untreated material. This remedy and the proposed Treatment Objectives were selected as part of the OU3 - Group III Impoundments Record of Decision (ROD), dated October 8, 1998.

The Remedial Design Report for Group III (February 1999) specified the need for completing larger-scale pilot testing to gather the data necessary to design and permit a full-scale aerobic biotreatment program. Larger-scale pilot tests were designed and implemented in 2000. In 2002, Impoundments 14 and 20 were excavated and placed in managed stockpiles on site, to drain excess water from the material by gravity in anticipation of the aerobic biotreatment programs, both larger-scale pilot testing and full-scale. The stockpiles were labeled Bins 1 through 4.

As the pilot-testing portion of the program progressed, it became evident that the nature of the waste material made control of odors and emissions of toxic compounds extremely difficult. Further effort was undertaken to obtain data needed to obtain an air permit for the full-scale process, and baseline risk modeling was completed to identify the potential exposure risks from air emissions, as required by the NJDEP Air Quality Permitting Program. This air data, and subsequent exposure modeling, indicated that treating air releases during aerobic biotreatment would be far more difficult than anticipated at the time of the OU3 ROD.

More importantly, the results of the larger pilot program conducted in 2000 showed that aerobic biotreatment could reduce the contaminant levels; however, the tests also revealed that the heterogeneity of the material was such that, on a larger scale, aerobic biotreatment was ineffective at meeting the treatment objectives within the time frames expected in the OU3 ROD. Based on these developments, Wyeth initiated a study reevaluating the appropriateness of using aerobic biotreatment on the Category B material. This reconsideration was presented in the "Inappropriateness of Biotreatment for Group III Material Category B Report", submitted April 2004. The conclusion reached in this report, that aerobic biotreatment was no longer the most appropriate remedy for this material, was accepted by NJDEP and EPA in July 2005.

As a result of the inappropriateness determination, Wyeth began considering other potential remedies for the material from Impoundments 14 and 20 as part of a new Focused Feasibility Study (FFS). Additional analytical testing and evaluations were conducted during the FFS to assist and support the decision making process. These studies showed that contaminant concentration reduction was evident within the material staging areas. Further analysis indicated that anaerobic biodegradation was likely occurring. These storage conditions, designed for safe and secure storage until a new remedy could be identified, supported anaerobic microbial activity within the storage stockpiles. This information changed the focus of the assessments from that of an FFS to documentation of treatment and presentation of the plan for completing the remedial program for Impoundments 14 and 20.

As part of the FFS, in October 2005, a total of twelve samples were collected from Bin 3 (one sample per approximately 400 cubic yards of material). The samples were collected to preview additional characterization information for use in the selection of remedial alternatives. The results of the Bin 3 sampling appeared to indicate the concentrations of the compounds of concern in the stockpiled material were significantly lower than previously observed. The handling completed on the material to date (excavation, mixing, and staging for draining of free liquids) resulted in conditioning the material for biodegradation. To provide further verification that this was indeed occurring, additional samples were collected from a separate bin. In December 2005, twelve additional samples were collected from Bin 1 (one sample per approximately 400 cubic yards).

Examination of the October and December 2005 sampling results and comparison to past results of sampling of material in the managed stockpiles, indicated that concentrations of the eight treatment objective

compounds had dropped significantly since the excavation and placement of the material in the bins. Mean compound concentrations (in parts per million, ppm), and the overall reductions of Treatment Objective compounds since their placement in the managed stockpiles approximately 42 months earlier, is summarized in Table 1, below.

Table 1. Reduction of Treatment Objective Compounds

	2 months (7/16/02)	24 months (4/28/04)	40 months (10/20/05 and 12/13/05)	Reduction
VOC				
Benzene	3,498	3,105	2,529	27.7%
Toluene	339	323	219	35.4%
Xylene	1,446	1,432	1,203	16.8%
Overall VOC	*5,283*	*4,860*	*3,952*	*25.2%*
SVOC				
1,2-Dichlorobenzene	96	71	14	85.2%
2-Methylnaphthalene	154	NA	50	67.4%
Naphthalene	20,225	24,367	7,250	64.2%
Nitrobenzene	1,719	808	265	84.6%
n-Nitrosodiphenylamine	5,145	2,227	642	87.5%
Overall SVOC	*27,338*	*27,473*	*8,221*	*69.9%*

* All results reported in parts per million.

Anaerobic degradation was found to effectively treat the SVOC compounds, and had shown some potential in treating the VOC. Based upon these results, Wyeth evaluated the effectiveness of anaerobic biodegradation in treating VOC to meet the Treatment Objectives in the OU3 ROD. Based on site-specific analysis and surveys of this treatment method at other VOC sites, Wyeth concluded that further reduction of VOC concentrations, even with much longer treatment times, could not be expected. Also considered in this analysis was the long-term durability of the managed stockpiles. Impoundments 14 and 20 were excavated and placed in the managed stockpiles in 2002, and the temporary stockpiles were expected to store the material for a few years at most while the aerobic treatment units were completed. The fabric cover has lasted well up until now, but it is nearing the end of its useful life. While other remedies for the Impoundments 14 and 20 material could be considered during the Comprehensive Site-Wide Feasibility Study, that study is still ongoing, and the managed stockpiles cannot be maintained without a substantial additional efforts. Given these factors, NJDEP and EPA have determined that continuing to stage the Impoundment 14 and 20 material until other remedies might be considered would not be appropriate.

With this document NJDEP, with EPA concurrence, modifies the selected remedy as follows:

Based on data obtained from on-site studies, documented in the approved Remedial Action Plan (O'Brien & Gere, January 2006), and summarized herein, the stockpiled material from Impoundments 14 and 20 will be solidified as required for strength purposes, and placed in Impoundment 8 in accordance with the Remedial Action Plan using the Revised Treatment Objectives as summarized in Table 2 below.

Table 2 Treatment Objectives

Compound of Concern	1998 OU3 ROD Treatment Objective (mg/kg)	Revised Treatment Objectives (mg/kg)
Benzene	60	2,529
Toluene	145	219
Xylene	230	1,203
1,2-Dichlorobenzene	320	320
2-Methylnaphthalene	1,900	1,900
Naphthalene	13,100	13,100
Nitrobenzene	5,200	5,200
N-nitrosodiphenylamine	14,300	14,300

*Treatment Objectives for metals will be RCRA leachate concentration levels based on Toxicity Characteristic Leaching Procedures analysis.

Wyeth will solidify the material to the maximum extent practicable within the framework of remedial and air pollution control permitting requirements. The manner in which compliance will be demonstrated will be specified in an amended Remedial Action Plan.

Support Agency Concurrence

The EPA concurs with this modified remedy. Attached is a concurrence letter from EPA dated 17May2007.

Affirmation of Statutory Determinations

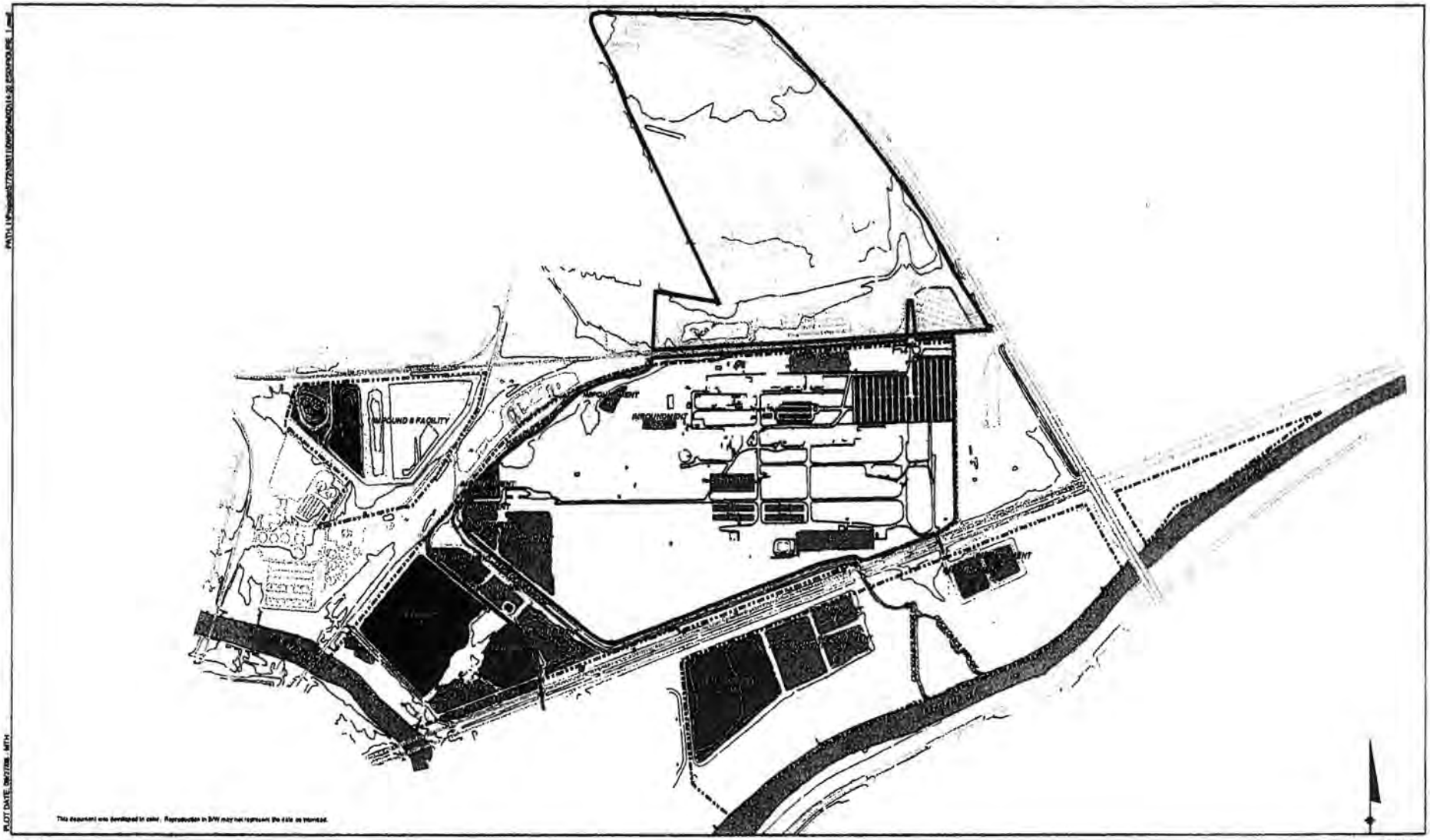
NJDEP, with the concurrence of EPA, is issuing this ESD. When implemented, the remedy, as modified by this ESD, will continue to be protective of human health and the environment, and will comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action.

Public Participation Activities

The ESD and documents that provide the basis of the ESD decision have been incorporated into the Administrative Record for the Site in accordance with Section 300.835(a)(2) of the NCP. In accordance with the NCP, a formal public comment period is not required when issuing an ESD. However, NJDEP and EPA will publish a notice of the availability of the ESD and a brief description in a local newspaper of general circulation in accordance with Section 300.435(c)(2)(i) (B) of the NCP. The Administrative Record is available for review during business hours at NJDEP, 401 East State Street, Trenton, New Jersey, 08625 (Phone: 609-633-1339), EPA Region 2, Records Center - 18th Floor, 290 Broadway, New York, New York, 10007 (Phone; 212-637-3261) at the information repository in the Somerset County Library, North Bridge Street and Vogt Drive, Bridgewater, New Jersey, 08807 and at the Bridgewater Township Municipal Office, 700 Garretson Road, Bridgewater, New Jersey 08807 (Phone: 908-725-5750)

Irene Kropp
Assistant Commissioner
Site Remediation Program

Date 5/31/07



Legend

- Flood Control Dike
- Property Boundary
- Former Hit Property
- Excavated/Closed Impoundments; Material Stockpiled & Awaiting Final Disposition
- Impoundments Requiring Remediation
- Remediated Impoundments
- RCRA Lagoon
- Impoundments Never Used for Disposal
- Impound B Facility

WYETH HOLDINGS CORPORATION
BOUND BROOK REMEDIAL PROGRAM
BRIDGEWATER, NEW JERSEY

SITE MAP

FILE NO.
5772/38311
DATE
August 2008

FIGURE 1

O'BRIEN & GERE ENGINEERS INC.